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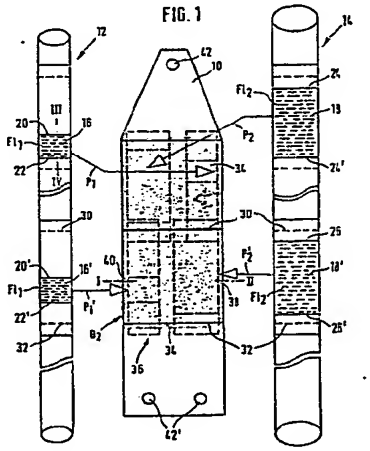
(54) Information input sheet.

(57) The structure of an information input sheet to be mounted on the information input board of a written information input terminal is provided. The information input sheet is constructed of a first flexible conductive layer (1 to 5) to which a pressure is directly applied by a writing utensil, a second conductive layer (6, 8) disposed facing the first conductive layer, and a plurality of insulators (7) disposed uniformely to define a space between the first and second conductive layers. The thickness of the first conductive layer is selected to be greater than an average distance between the edges of adjacent insulators, whereby as the first conductivity layer is deformed by a pen pressure, the first conductivity layer contacts the second conductivity layer while embracing some of the plurality of insulators.

FIG. 1



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Description

INFORMATION INPUT SHEET

BACKGROUND OF THE INVENTION

The present invention relates to the structure of an information input sheet, and more particularly to an information input sheet to be mounted on the information input board of a handwritten information input terminal by which the information regarding a coordinate position of the sheet where a pressure is being applied can be detected.

A system wherein handwritten characters, marks, figures and the like are read in real time by a handwritten information input terminal, and the read-out information is sent to a memory and processor apparatus such as a computer to efficiently handle business matters, has now been popularized.

Various types of such a handwritten information input terminal have been proposed. Generally, handwritten information, e.g., characters are detected from the coordinate positions of the characters. In particular, a flexible conductive sheet is placed upon a resistive substrate with insulating spacers interposed therebetween. As a character is written with a pen on the conductive sheet, the pen pressure forces the conductive sheet to deform and contact the resistive substrate. Electric leads are connected to the horizontal and vertical side edges of the resistive substrate and to the conductive sheet to measure the resistance values at the pen position in the horizontal and vertical directions. The coordinate values of the pen position on the conductive sheet can be identified from the measured resistance values.

Insulators for electrically insulating the flexible conductive sheet from the resistive substrate are formed in a mesh pattern, a dot pattern or the like. It is important to select the proper dimension and interval of insulators because these factors have a great influence upon the quality of inputted image, the smoothness of writing and the like.

Examples of the layered structure applicable to an information input sheet are disclosed in USP. No. 3,911,215 by Hurst et al., filed on March 18, 1974 and issued on October 7, 1975 and in USP. No. 4,636,582 by Moriwaki et al., filed on August 29, 1984 and issued on January 13, 1987.

Irrespective of the types of insulator pattern, if the tip of a pen applying a pressure to the flexible conductive sheet is thicker than a certain value relative to the interval between insulators, the insulator prevents the conductive sheet from contacting the resistive substrate even if a pen pressure is being applied. A conventional flexible conductive sheet is thin relative to the dimension of an insulator. Therefore, the interval between insulators is set small so as not to sensitive to undesired pressure other than the pen pressure. Accordingly, the smaller the interval between insulators is set, the thinner the tip of an allowable pen becomes. In addition to the above restriction, if a pen of thin tip is used with a thin flexible conductive sheet, it may be located just upon the lattice of a mesh insulator or upon a dot insulator so that the insulator prevents the conductive sheet from contacting the resistive substrate. In this case, the coordinate position cannot be detected so that the input image becomes discontinuous. Further, a thin conductive sheet has insufficient elasticity required for a proper function of the conductive sheet, and a pen is likely to scratch the thin sheet at above an insulator to thus loose the smoothness of writing.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a novel information input sheet solving the above-described problems. To achieve the above object, according to the present invention, the thickness of a flexible conductive sheet is set greater than an average distance between the edges of adjacent insulators so that as the flexible conductive sheet deforms under a pressure, the flexible conductive sheet contacts a resistive substrate (resistive layer) while embracing some of a plurality of insulators.

The sheet structure of this invention as described above presents the advantageous effects that an undesired pressure other than a pen pressure is not detected, and a pen of any tip thickness can provide a continuous image input and a smoothness of writing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross section of an embodiment of an information input sheet according to the present invention;

Fig. 2 shows a part of the sheet shown in Fig. 1 as viewed from the bottom;

Fig. 3 is a cross section of the sheet embodiment shown in Fig. 1 while a pressure is being applied by a pen;

Figs. 4A to 4D show various examples of the contact state between the conductive layer and the resistive layer; and

Fig. 5 is a perspective view showing an information input board using the information input sheet of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the information input sheet of this invention will be described with reference to Figs. 1 to 4.

Fig. 1 is a cross section of an embodiment of the information input sheet according to the present invention. A flexible conductive sheet is constructed of an elastic layer 2 made of a flexible material such as polyurethane and a conductive layer 1 which is formed by coating conductive ink on the bottom surface of the elastic layer 2. A shield layer 3 is

provided on the top surface of the elastic layer 2 by coating conductive ink thereon. The shield layer 3 is grounded at the ground potential point (not shown) of the information input sheet to eliminate static electricity from hand and shield external noises. There is further provided a transparent protective film 5 on the shield layer 3, the transparent protective film 5 having a Shore hardness greater than that of the elastic layer 2. Frames for title and operation entries, figures, symbols, legends and the like are printed on the bottom surface of the protective film 5. Desired information is inputted with a pen on the protective film 5 in handwriting. The conductive layer 1, elastic layer 2, shield layer 3 and protective film 5 are laminated one upon another as shown in Fig. 1. The laminated structure as a whole is constructed such that the structure allows flexibility with deformation and restoration sufficient for a certain pen pressure. In this embodiment, insulators 7 of a dot pattern are formed on the bottom surface of the conductive layer by coating insulating ink by means of a printing technique. The insulators 7 have proper elasticity so as to be deformed and crushed upon application of a pen pressure on the sheet. Fig. 2 shows a part of the insulators 7 and the flexible laminated structure as viewed from the bottom. Each insulator 7 is generally of a trapezoid shape with its central portion gradually projecting downward. The insulators 7 are disposed at an equal pitch over the bottom surface of the conductive layer 1. The present invention is not limited to the shape shown in Fig. 2, but the shape of the insulator 7 may be a circle or other shapes.

It is preferable that the thickness of the elastic layer 2 made of polyurethane is in the range of about 0.3 to 1.0 mm, and the thickness of the protective film 5 is in the range of about 0.05 to 0.2 mm. It is preferable that the Shore hardness of the elastic layer 2 and the protective film 5 is in the range of 65° to 95°, the Shore hardness of the protective film 5 being set greater than that of the elastic layer 2. The condition that the elastic layer 2 is softer in Shore hardness than that of the protective film 5 provides improvement in the recovery and response to the pen pressure on the writing surface is improved. The condition that the protective film 5 is harder than the elastic layer 2 provides smooth pen moving in the transverse direction and light reaction to the operator. It is also preferable that the bottom side ℓ of a trapezoid of the dot type insulator 7 is in the order of 0.3 to 0.4 mm, and the height h is about 0.01 to 0.07 mm, and the pitch d between adjacent insulators is about 0.15 to 0.5 mm. The bottom side ℓ of the dot type insulator 7 is preferably greater than five times the height h.

A resistive layer 6 having a predetermined resistivity and attached on the top surface of an insulating substrate 8 made of such as bakelite or glass epoxy is disposed under the insulating layer 7. An aluminum shield box 9 grounded to the ground potential point covers the information input sheet except the pen input surface of the sheet. Instead of using the aluminum shield box 9, a conductive plate such as an aluminum plate connected to the ground potential point may be placed under the insulating substrate 8 and a box made of plastics may be used to cover the information input sheet. Such shielding prevents noises entering from the bottom surface of the information input sheet. Unless a pen is pushed against the input surface of the protective film 5, the conductive layer 1 and the resistive layer 6 are spaced apart by the insulators 7 and electrically open-circuited (insulated) as shown in Fig. 1.

Fig. 3 is a cross section of the information input sheet constructed as above wherein a writing utensil, an input contact member or the like is pushed against the input surface of the sheet. Elements designated by identical reference numerals to those in Fig. 1 represent like elements, so the description therefor is omitted. In Fig. 3, reference numeral 10 denotes the tip of a writing utensil or pen. As seen from Fig. 3, upon application of a pen pressure by the pen tip 10 to the information input sheet in the direction indicated by an arrow, the laminated flexible structure deforms while the polyurethane elastic layer 2 deforms with some of the spaces between adjacent insulators being filled with the elastic layer 2. Therefore, the conductive layer 1 coated on the elastic layer 2 is pushed downward by the deformed elastic layer 2 and contacts a partial area of the resistive layer 6 while embracing some of the insulators within the area. Such deformation of the elastic layer 2 is realized under the condition that the thickness of the elastic layer 2 is set substantially the same as or greater than an average distance between the edges of adjacent insulators 7, and substantially the same as or greater than an average length of bottom sides ℓ of the insulators 7. Since the shield layer 3 and the protective film 5 are also flexible, the thickness of the elastic layer 2 may be considered as including the thicknesses of the shield layer 3 and the protective film 5. If the elastic layer 2 is made of a flexible layer (elastomer) containing a conductive material such as carbon, the conductive layer 1 needs not be provided. The material of the dot type insulators 7 is selected from those materials softer than that of the elastic layer 2. Preferably, the soft nature of the material is determined such that although the insulator 7 is more or less crushed upon application of a pen pressure, it deforms while being pushed into the elastic layer 2 without extending laterally. In this embodiment, since the insulator 7 is deformed and crushed upon application of a pen pressure, it helps the conductive layer 1 contact the resistive layer more broadly, which also results in an improved smoothness of writing.

With the construction as above, the conductive layer 1 can contact the resistive layer 6 upon application of a pressure by a writing utensil of any tip thickness. Such contact may occur under too high a pressure by a palm or a finger. However, assuming that the ordinary pressure applied to the sheet when a plam or a finger is placed thereon is substantially the same as a pen pressure, the conductive layer 1 cannot contact the resistive layer 6 because the pressure per unit area by the plam or finger is considerably low as compared with that by the writing utensil. Therefore, undesired input due to the touch by a palm or finger can be avoided.

Figs. 4A to 4D show the contact state between the conductive layer 1 and the resistive layer 6 upon application of a pen pressure to the information input sheet of the above embodiment according to the present invention. In Figs. 4A to 4D, a black solid circle represents the insulator 7, and a hatched portion represents a contact area between the deformed conductive layer 1 and the resistive layer 6. A difference between the contact states of Figs. 4A and 4B results from a different thickness of a pen tip. A thinner pen is used in Fig. 4A than in Fig. 4B. Two hatched portions in Fig. 4A indicate that a pen was pushed twice against the sheet at two different positions. In both the cases, it can be understood that the conductive layer 1 is deformed by a pen pressure with some of the spaces between insulators 7 being filled with the elastic layer 2 and reliably contacts the resistive layer 6 over a broad area. Fig. 4C shows the case where a pen locates just upon one of the insulators 7. Also in this case, the elastic layer 2 is deformed by a pen pressure and hence the conductive layer 1 is deformed to contact a partial area of the resistive layer 6 while embracing some of a plurality of insulators 7 within the area. Fig. 4D shows the case where an insufficient pen pressure is applied or a palm or finger touches the sheet. In this case, the conductive layer 1 and the resistive layer 6 are not allowed to contact each other.

Fig. 5 is a perspective view of an information input board of a handwritten information input terminal to which the information input sheet of this invention is applicable.

The information input sheet shown in Fig. 1 is represented by reference numeral 11 and is disposed on the board with the protective film 5 facing upward. An entry form sheet 12, various types of which may be provided for different users, is placed on the information input sheet 11. Necessary information is depicted in the entry form sheet 12 with a pen 13 so that the information is supplied to the information input sheet in the form of pen pressure. An input information display 14 may use, e.g., a liquid crystal display panel on which handwritten information such as characters and symbols are displayed. The information input board is connected to a control unit 15 via a cable. The control unit 15 can recognize handwritten information using a built-in CPU and store the data in a memory, and supply power to the information input sheet. The control unit 15 is coupled to a host computer (not shown) to process the inputted information.

Claims

1. An information input sheet comprising:
a first flexible conductive layer (1 to 5);
a second conductive layer (6, 8) mounted facing said first conductive layer; and
a plurality of insulators (7) disposed uniformely between said first and second conductive layers to define a space therebetween, upon application of a pressure to the surface of said first conductive layer, said first conductive layer being deformed at the portion where said pressure is being applied and contacting said second conductive layer; wherein
the thickness of said first conductive layer is selected so as to have substantially the same as or greater than an average distance between the edges of adjacent insulators, and substantially the same as or greater than an average width of said insulators, and whereby as said first conductive layer is deformed at the portion where said pressure is being applied and contacts said second conductive layer while embracing some of said plurality of insulators.

2. An information input sheet according to claim 1, wherein said second conductive layer comprises a resistive layer (6, 8).

3. An information input sheet according to claim 2, wherein said plurality of insulators are fixedly connected to the surface of said first conductive layer (1 to 5) facing said second conductive layer.

4. An information input sheet according to claim 3, wherein said first conductive sheet (2) comprises a layer (2) made of a flexible material, and a layer (1) made of a conductive material for contacting said second conductive layer.

5. An information input sheet according to claim 3, wherein said layer (2) of said first conductive layer made of a flexible material includes a third conductive layer (3) for electrically shielding said second conductive layer (6).

6. An information input sheet according to claim 5, wherein said second conductive layer (6, 8) includes a substrate (8) and a resistive layer (6), and said layer (2) of said first conductive layer made of a flexible material includes said flexible layer (2), said third conductive layer (3) covering said flexible layer (2), a print sheet (4) covering the top surface of said third conductive layer, and a protective sheet (5) covering the top surface of said print sheet (4), and said information input sheet is constructed in a laminated structure of said second conductive layer (6, 8), said plurality of insulators (7) and said first flexible conductive layer (2).

7. An information input sheet according to claim 6, wherein the thickness of said layer made of flexible material and said protective sheet is selected to be in the range of 0.3 to 1.0 mm and in the range of 0.05 to 0.5 mm, respectively.

8. An information input sheet according to claim 7, wherein the Shore hardness of said layer made of a flexible material and said protective sheet is selected in the range of 65° to 95°, and said Shore hardness of said protective sheet is selected greater than that of said layer made of flexible material.

9. An information input sheet according to any one of claims 1 to 8, wherein said plurality of insulators are made of a flexible material.

10. An information input sheet according to

any one of claims 1 to 9, wherein said plurality of insulators have said average distance between said edges and said average width which are substantially the same.

11. An information input sheet according to any one of claims 1 to 10, wherein said plurality of insulators are dot type insulators disposed independently and dispersedly.

FIG. 1

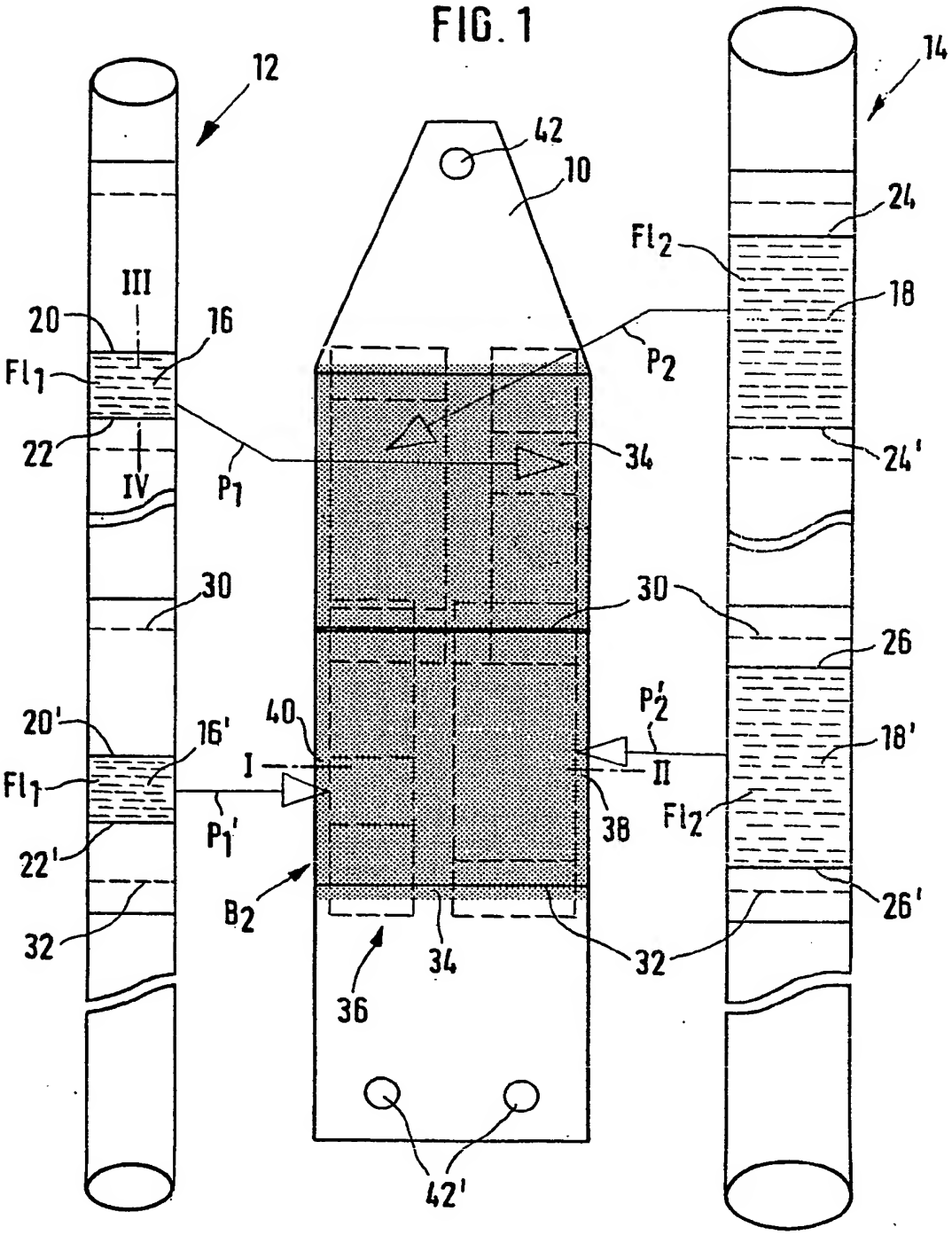

FIG. 3

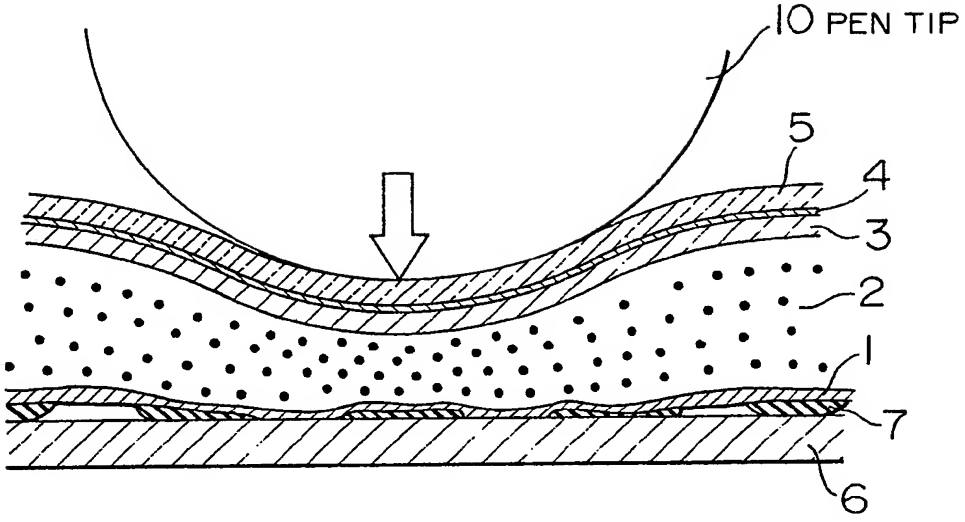

FIG. 4A FIG. 4B FIG. 4C FIG. 4D

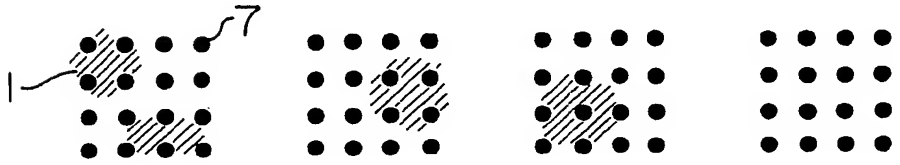

FIG. 5

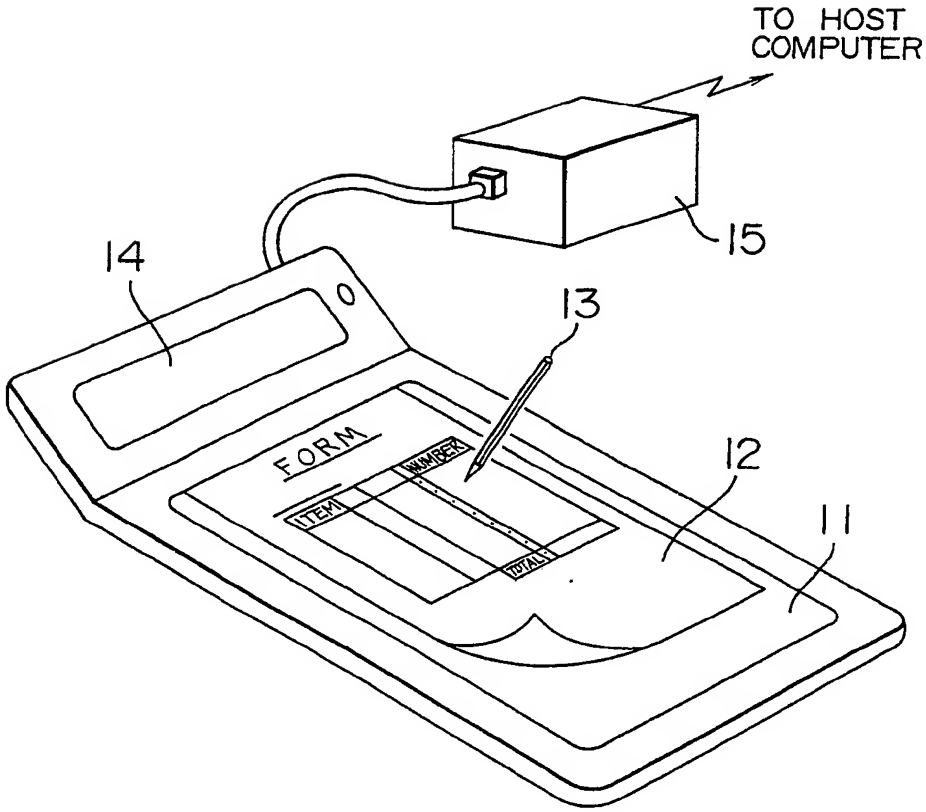

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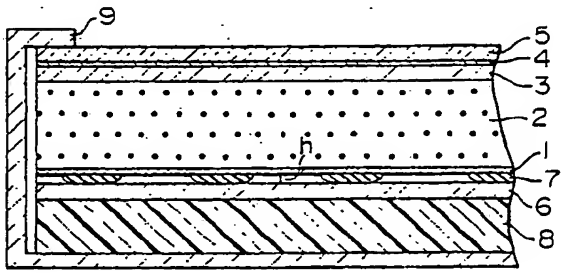
FIG. 1



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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 6935

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A,D	US-A-4 636 582 (MASAFUMI MORIWAKI et al.) * Column 5, line 57 - column 6, line 54; figure 9 * ---	1-7,9-11	G 06 K 11/06 G 06 F 3/033
A,D	US-A-3 911 215 (GEORGE S. HURST et al.) * Column 2, line 42 - column 3, line 6; column 4, lines 24-54; claims 1-6; figure 5 * ---	1-4,7,9-11	
A	EP-A-0 054 406 (MOORE BUSINESS FORMS, INC.) * Page 4, line 1 - page 5, line 6; page 7, lines 1-10; page 8, lines 1-16; page 9, lines 16-20; page 11, lines 5-25; figure 6 * -----	1-4	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 06 K 11/06
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23-01-1990	ALONSO Y GOICOLEA L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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